COMBING DEVICE WITH ADJUSTABLE TEETH SPACING

FIELD OF INVENTION

This invention relates generally to hair care means such as hair care devices, attachments and apparatus and, more particularly, to hair care devices, attachments and apparatus with means for combing hair, including combs and hairbrushes. More specifically, although of course not limited thereto, this invention relates to hair care devices with means for adjusting tension on the hair and heating means to heat or warm the hair under tension. This invention also relates to a hair care apparatus with an air blower and a combing attachment with an adjustable spacing between the teeth which can be coupled as an attachment to a hair care apparatus with air blower.

BACKGROUND OF THE INVENTION

Hair care devices with means for imparting tension to hair are known and widely used for general hair care such as combing and styling or for smoothing and tidying hair which has become messy. These types of hair care apparatus are also used to perform hair treatments as well as removing dirt and disentangling greasy and lumpy hair.

US Patent 5,729,907 describes such a hair care device as an attachment for a hair dryer with a comb and a heat transmissive plate for simultaneously drying and straightening of one's hair.

US Patent 3,939,850 describes a combined hair comb and dryer device having baffles arranged to focus the warm hair moving through the device towards the hair as the hair is moving through the comb.

United Kingdom Publication No. GB 2,365,335 describes a hair care apparatus with a combined hair dryer and comb for drying and straightening hair.

Hair care apparatus and devices having means for combing or imparting tension to hair, such as the ones described above, usually include a plurality of elongated teeth which are distributed along its length and overhanging an elongated base of the main housing of the devices or apparatus. In use, the elongated teeth engage with hair and are intermediate of the scalp and the handle portion of the apparatus or devices. Known hair care devices, attachments and apparatus with such combing or tension imparting characteristics usually suffer from the common shortcoming that the teeth spacing is not always suitable which means that different devices, attachments or apparatus must be selected for different persons in order to achieve optimal styling, caring or treatment to hair of different thickness or characteristics. Hence, it will be highly desirable if there can be provided devices, attachments or apparatus with such features which alleviate shortcomings of such conventional means or devices. Such devices or apparatus should be relatively simple and easy to use without requiring complicated or careful adjustment steps.

OBJECT OF THE INVENTION

It is therefore an object of the present invention to provide improved hair care devices, attachments and apparatus having combing or tension imparting

means which alleviate shortcomings of known means and devices. It is also an object of this invention to provide an attachment for hair care apparatus or a hair care device or apparatus with combing means having adjustable teeth spacing suitable for use in hair blowing, straightening or styling. Of course, the above objectives are to be read disjunctively with the minimum of providing the public with a useful choice.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention, there is provided a hair care device including hair combing means and means for adjusting effective teeth spacing between adjacent combing teeth, said hair combing means including a plurality of combing teeth, characterised in that at least some of said combing teeth being thermally conductive so that heat can be conducted from said combing means to said hair via said thermally conductive combing teeth when said hair is being engaged under tension by said combing teeth.

Preferably, the engaging tension on said hair being adjustable by varying the effective teeth spacing between said adjacent combing teeth.

In a preferred embodiment, said hair combing means including a first comb row and a second comb row each having a plurality of comb teeth, said first and said second comb rows being relatively movable so that the effective teeth spacing transversely across said combing means being variable by relative movement of said first and said second comb rows, wherein, at least some of said comb teeth being thermally conductive so that, when hair is engaged under

tension by said comb assembly, heat can be transmitted to said hair via said thermally conductive comb teeth.

In a preferred embodiment, at least some of the comb teeth on said first and second comb rows being adapted so that the effective teeth spacing transversely across said combing means being adjustably by relative movements between said comb rows.

Preferably, the width of said some of said comb teeth being comparable to their teeth spacing.

Preferably, the width of said some of said comb teeth being comparable to the teeth spacing between correspondingly adjacent comb teeth.

In a preferred embodiment, said hair care device including heating means, wherein said heating means being disposed so that heat generated by said heating means can be transferred from said heating means to the hair via said combing means.

Preferably, said combing means including first combing means and second combing means which are relatively movable.

In a preferred embodiment, said hair care device including a main housing, wherein said first combing means being movable relative to said main housing, said first combing means includes a first comb row, said second combing means includes second and third combs, said first, second and third comb rows being generally parallel and said first comb row being intermediate of said second and third rows, wherein the effective combing teeth spacing of said combing means

transverse to said comb rows being adjustable by relative movements of said first, second and third comb rows.

Preferably, said second and third combing rows being generally thermally conductive.

Preferably, said second combing means including metallic combing teeth extending from a metallic base.

In a preferred embodiment, each of said first, second and third comb rows including a plurality of generally parallel combing teeth, wherein the teeth of said comb rows being adapted so that the effective teeth spacing across said combing means being adjustably by relative movements of said comb rows.

In a preferred embodiment, including a handle, said first and second combing means being respectively movable and stationary relative to said handle, the width of the teeth on said first combing means being comparable to the teeth spacing between corresponding adjacent teeth or teeth pairs on said second combing means so that the effective spacing across said combing means being adjustable by movement of said first combing means.

Preferably, at least some of the teeth on said second combing means are thermally conductive so that when hair is engaged by said comb assembly, heat can be transmitted to said hair via said thermally conductive teeth.

In a preferred embodiment, said hair care device including a handle, wherein relative movements between said first and said second combing means being actuatable by an actuation button which is pivotable about a hinge, the

movable combing means being urged away from said handle while said button is being depressed.

Preferably, said actuation button being under spring urge to return said movable combing means towards said handle when the actuation button is released.

Preferably, said first and second combing means being relatively translatable along a first orientation, said combing teeth being generally elongated and extending along a second orientation, wherein relative translation between said first and second combing means along said first direction will cause said elongated teeth on one combing means to traverse the spacing between adjacent teeth pairs on the other combing means to vary the effective teeth spacing of said device, said means for adjusting said effective teeth spacing controls the relative translation between said first and second combing means.

Preferably, said means for adjusting said effective teeth spacing includes a rotatable wheel.

In a preferred embodiment, a complete revolution of said rotatable wheel about its axis of rotation will move a combing tooth to a position previously occupied by an adjacent tooth.

Preferably, said rotatable wheel being connected to a turning knob, said turning knob including a screw-threaded shaft, the longitudinal axis of said shaft being parallel to said first direction.

Preferably, said first and said second directions being substantially orthogonal.

Preferably, said means for adjusting said effective teeth spacing including means to gradually translate one of said combing means.

Preferably, said gradual translation of said one of said combing means being driven by a screw-threaded rotary shaft, the longitudinal axis of said screw-threaded shaft being parallel to said first direction.

Preferably, said teeth spacing adjusting means further include means to maintain said one of said combing means at pre-determined positions along said first direction.

Preferably, said pre-determined positions correspond to discrete settings of the effective teeth spacing of said device.

Preferably, the teeth spacings on said first and second combing means being generally equal.

Preferably, said main housing include a hollow member with an air-inlet, an air-outlet, and a neck portion interconnecting said air-inlet and said air-outlet, said comb members being disposed at said air-outlet with said teeth pointing away from said air-outlet.

Preferably, said main housing includes means for coupling to the nozzle of a hair care apparatus with a blower.

Preferably, said device being a hair brush or hair brush attachment wherein said teeth are formed from bristles and said second direction along which said bristles extend being radial from the longitudinal axis of said brush.

According to another aspect of the present invention, there is provided a hair care device comprising:

- a main housing;
- at least a first comb mounted on said housing;
- at least one second comb mounted on said housing on a generally parallel axis to said first comb and movable with respect to said first comb along said parallel axis such that teeth on said second comb may move intermediate of said teeth on said first comb to reduce the teeth spacing in a transverse direction;
- actuating means to actuate movement of said second comb; and
- a pressure limiting mechanism to inhibit further movement of said second comb once a threshold pressure against further movement be reached caused by hair intermediate of the teeth of said first and second combs.

Preferably, said second comb member is biased by a first biasing means towards a position in which teeth of said first and second combs are substantially in line with each other in said transverse direction.

Preferably, said actuating mechanism overcomes said first biasing means to actuate movement of said second comb.

Preferably, said pressure limiting mechanism comprises a second biasing means acting on or within said actuating mechanism to allow further movement of said actuating mechanism without further movement of said second comb once a threshold of said second biasing means has been reached.

Preferably, said actuating mechanism includes button actuatable by a user and an indirect connection between said button and said second comb whereby said indirect connection includes said second biasing means.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention will be explained in further detail by way of example and with reference to the accompanying drawings, in which:-

Fig. 1 is a top plan view of a comb attachment embodying a first preferred embodiment of the present invention with the teeth of the first and second combing members overlapping.

Fig. 2 is a side view of the attachment of Fig. 1 viewing from the left side,

Fig. 3 is a side view of the attachment of Fig. 1 viewing from the right side,

Fig. 4 is a cross-sectional view of the attachment of Fig. 1 taken along the sectional line A-A,

Fig. 4A is an enlarged view of the circled portion of Fig. 4,

Fig. 4B is an enlarged view showing the cross-section, upper (left) and under (left) of the adjustment knob,

Fig. 5 is a cross-sectional view of the hair attachment of Fig. 1 taken along the sectional line B-B,

Fig. 5A is an enlarged view of the circled portion of Fig. 5.

Figs. 5B and 5C are partial cross-sectional views of the hair attachment of Fig. 1 taken respectively along the line C-C and D-D of Fig. 4,

Fig. 6 is a top plan view showing the comb sub-assembly detached from the rest of the attachment,

Fig. 6A is the front view of Fig. 1 with the comb members removed,

Fig. 7 illustrates the operation of the adjustment knob to vary the teeth spacing of the attachment of Fig. 1,

Fig. 7A is an enlarged view showing the circled portion of Fig. 7,

Fig. 8 is a top plan view of a comb attachment embodying a second preferred embodiment of the present invention,

Fig. 9 is a cross-sectional view of the comb attachment of Fig. 8 taken along the line A-A,

Fig. 9A is partial cross-section of the attachment of Fig. 8 taken along the line C-C,

Fig. 9B is a front view of the attachment of Fig. 8 with the comb sub-assembly removed,

Fig. 9C is an enlarged view of the circled portion showing in more detail the engagement means being connected with the lower portion of the pivotal cock,

Fig. 10 is a cross-sectional view of the attachment of Fig. 8 along the line B-B and Fig. 10A is an enlarged view of the circled portion,

Fig. 11 is a rear view of the comb attachment of Fig. 8 revealing in more detail the pivotal cock for moving the engagement tab,

Fig. 12 is a front view of a hair comb of a third embodiment of the present invention with the comb members removed,

Fig. 13 is a top view of the hair comb of Fig. 12 with the comb members intact,

Fig. 14 is a cross-sectional view of the hair comb of Fig. 13 taken along the line A-A of Fig. 12,

Fig. 15 is the side view of a fourth embodiment of the present invention configured as a hair comb,

Fig. 16 is a top view of the hair comb of Fig. 15,

Fig. 17 is a cross-sectional view of the hair comb of Fig. 15 exposing the more important features of the teeth adjustment means,

Fig. 17A is a cross-sectional view of a modified version of the hair comb of Fig. 15 exposing the fixed and movable comb members as well as the teeth adjusting means,

Fig. 18 is a cross-sectional view of a hairbrush showing a fifth preferred embodiment of the present invention,

Fig. 19 is a cross-sectional view of a hair brush showing a sixth preferred embodiment of the present invention,

Fig. 19A is a cross-sectional view taken along the line A-A of Fig. 19,

Fig. 20A is a front elevation of a hair care apparatus in accordance with a yet further embodiment of the invention,

Fig. 20B is a side elevation of the apparatus of Fig. 20A,

Fig. 20C is a cross-sectional end elevation through the axis A-A on Fig. 20A,

Fig. 20D is a cross-sectional front elevation of the apparatus of Fig. 20A,

Fig. 20E is a cross-sectional end elevation on axis B-B from Fig. 20D,

Fig. 20F is an end elevation of the apparatus of Fig. 20B,

Fig. 21A is a front elevation of a yet further embodiment of the apparatus,

Fig. 21B is a side elevation of the apparatus of Fig. 21A,

Fig. 21C is a partial cross-sectional elevation on axis A-A from Fig. 21A,

Fig. 21D is a partial cross-section on axis B-B on Fig. 21B,

Fig. 21E is a cross-sectional end elevation on axis C-C from Fig. 21C,

Fig. 22A is a front cross-sectional elevation of a yet further embodiment of the apparatus,

Fig. 22B is a side cross-sectional elevation of the apparatus of Fig. 22A,

Fig. 22C is an end elevation of the apparatus of Fig. 22B, and

Fig. 22D is a cross-sectional end elevation of the apparatus of Fig. 22A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figs. 1 to 7A, there is shown a first preferred embodiment of a hair care device of the present invention which is configured as a combing attachment. This combing attachment can be used with, for example, a hair-dryer or a hair blower. The combing attachment **1** includes hair combing means and means for adjusting the effective teeth spacing of the hair combing means. The hair combing means is mounted on a main housing **10** and includes a comb sub-assembly **20**. The comb sub-assembly includes a first comb row or first comb member **30**, a second comb row or second comb member **40**. The means for adjusting the effective teeth spacing includes teeth width adjustment means **50**. Each of the first comb member **30** and the second comb member **40** includes a

plurality of elongated teeth **31, 41** which extend from an elongated base portion **32, 42**. The directions of extension of the teeth and the base portion are generally substantially orthogonal.

Elongated teeth **31, 41** on the same comb member are generally parallel to each other and the separation between adjacent elongated teeth defines the teeth spacing. This teeth spacing defines the pitch of the corresponding comb member. In this example, the teeth spacings or the pitch **33, 43** between adjacent elongated teeth on the same comb member are substantially identical.

In addition, the width of the teeth and the teeth spacing on the same comb member are generally identical so that the combing teeth are substantially regularly distributed along the length of the base portion of the respective comb members. Throughout this specification, the width of the teeth spacing generally means the spread of the combing teeth along the length of the comb members or the combing means where appropriate. Also, the term effective teeth spacing generally means effective combing teeth spacing transverse to the length of the comb members.

The elongated teeth **31, 41** are substantially rigid or semi-rigid and are made of materials such as, for example, plastics, metal, bakelite, bone or the like. Of course, the elongated teeth can also be made of a flexible material such as soft plastics to form tufts or bristles. Where the elongated teeth are made of plastics or metal, the elongated teeth and the corresponding base portion can be integrally made by moulding or by stamping or pressing if from metal. For enhanced styling efficiency, the teeth **31, 41** are made of metal or other heat conductive materials.

As a variation, the elongated teeth can also be formed by tufts of bristles which are mounted on the base portion of the comb members as holders of the bristles. The first **30** and the second **40** comb members are mounted on the front portion of the main housing **10** so that the comb members **30, 40** are relatively movable in order to change, vary or adjust the effective teeth spacing of the comb attachment. This will assist to provide, for example, optimal teeth spacing for hair of corresponding specific thickness.

Since the hair being combed will have to pass through the effective teeth spacing of the comb attachment **1**, in order to perform appropriate combing, the optimal teeth spacing should be adjustable so that it is neither too wide to allow too many hair to pass through a single pitch at the same time nor too narrow which makes the comb too difficult to move through the hair. As hair will be engaged by the effective teeth spacing, a certain degree of tension can be exerted on the hair as the combing member moves along the hair. Appropriate adjustment of the effective spacing will put the engaged hair under suitable tension when the comb moves along the hair.

In order to adjust the effective teeth spacing or pitch, the first **30** and the second **40** comb members are disposed in a relatively translatable configuration so that the elongated teeth of one comb member (the "first comb member") can be moved towards and away from the teeth member of the other comb member (the "second comb member"). This will result in a range of effective teeth spacing by co-operating between adjacent teeth of the first and the second comb members. As a result of the relative movements between the first comb member **30** and the second comb member **40**, part of the teeth spacing on the first, movable, comb

member **30** is in turn covered by the elongated teeth on the second, fixed, comb member **40**, therefore changing the overall effective teeth spacing **34** of the comb attachment, as illustrated in Fig. 7A.

For the avoidance of doubt, it will be understood that throughout this description, the effective teeth spacing means the spacing between adjacent elongated teeth minus the spacing being covered or traversed by the teeth on another comb member.

Since the teeth pitches as defined by adjacent teeth on the same comb member are generally parallel to each other, it is preferred that the adjusted teeth spacings are also generally parallel to each other and also generally parallel to the elongated teeth of the comb members. As such, the comb members are relatively movable along a first direction so that the elongated teeth on the moving comb member will remain parallel to that of the other (stationery) comb member during the relative movements, although the comb members are disposed at a different level.

In general, the first direction above is parallel to the length of the elongated comb member and is at an angle or inclination to the orientation or lengthwise axis of the elongated teeth. The elongated teeth extend generally along a second direction so that the effective teeth spacing **34** can be conveniently adjusted. In the present preferred embodiments, the comb members are arranged so that the orientation of the elongated teeth is generally orthogonal to the direction of relative movements or translation between the comb members. Thus, the first and the second directions in this embodiment are generally orthogonal and the effective

teeth spacing is adjusted by relative movements of the comb members transversal to the second direction. Of course, the first and second direction can be non-orthogonal and can incline at an appropriate angle.

To provide further convenience, the adjustable comb sub-assembly is mounted on a head portion **11** which is detachable from the main housing **10**. As can be seen from Fig. 3, a latching means **12** is provided on the head portion **11** to facilitate detachability between the comb sub-assembly and the main housing.

Turning more particularly to Figs. 4 to 7A, the teeth spacing adjustment means and its operation will be explained in further details.

Referring more specifically to Figs. 4 to 5C, the second comb member **40** is fixedly connected to the main housing **10** and more specifically, to the head portion **11** of the main housing **10** with the teeth generally extending along the second direction from the base portion **42**. The head portion **11** of the main housing is also substantially rigid and includes a top, a bottom, sideguards and a front aperture exposing the comb teeth. The sideguards **111, 112** together form a bracket enclosing the teeth members and extend beyond the tip of the comb teeth to keep away hair outside the region being combed from entering the teethed regions. The first, movable, comb member **30** is supported by the second comb member **40** in a movable manner by supporting arrangements **13** which are shown in more detail in Fig. 5A.

The supporting arrangement **13** includes a rivet **131** which connects the first and the second comb members by its stem and traps the comb members by its heads. In order that the first comb member **30** can be movable along the

second direction, an elliptical aperture with an opening slightly larger than the diameter of the rivet stem is formed on the first comb member **30**. The elliptical aperture is sized so that the first comb member **30** can be translatable along the first direction while being retained by the rivet head.

A separator which is a washer **132** in the present example is placed between the comb members to reduce contact area and therefore fiction. To adjust the range of movement and to avoid the rivet from clamping directly on the first comb member, a metal liner **133** is introduced to surround the portion of this stem above the plane of the second comb member **40**. This metal liner **133** trims the space between the rivet stem and the aperture on the first comb member for an appropriate range of translation along the first direction, as well as elevating the head of the rivet above the base portion of the first comb member **30**.

In order to move and also to control the gradual movement of the first comb member **30**, the first comb member **30** is connected to a teeth spacing adjustment means **50** which includes a movement mechanism. The movement mechanism includes a rotary member having a circular head **51** and a screw-threaded shaft portion **52**. The shaft portion **52** is rotatably supported on the left sideguard **111** of the main housing.

To restrict the longitudinal movement of the rotary member relative to the sideguard **111**, a retention member which is a clip **53**, preferably engaging on a circular groove on the shaft **52**, is disposed adjacent to the sideguard of the head portion **11**. A nut **54** which is engaged on the threaded portion of a shaft **52** is engaged with an indentation formed on the base portion **32** of the first comb

member **30**. The engagement between the indentation and the nut **54** is preferably in a close-fitted manner so that any longitudinal translation of the nut **54** along the first direction as a result of the rotation of the circular head **51** of the rotary member will result in transactional movement of the first comb member along the first direction.

In order to restrict further, unwanted, movements of the movable comb member **30** once a preferred teeth spacing has been selected and set, corresponding holding means are formed on the underside of the rotary adjustment knob **51** and the outside of the sideguard **111**. This holding means **510** includes a small dome-shaped indentation **511** formed on the underside of the rotary adjustment knob **51** for engagement with a correspondingly shaped and positioned stud **512** on the outside of the sideguard **111**. The holding means **510** can be released from engagement by pulling the rotary adjustment knob **51** away from the sideguard **111** or by depressing the sideguard **111** carrying the rotary member towards the other sideguard **112**. The residual resilience of the substantially rigid head portion will then allow this dis-engagement of the holding means.

In order to allow the first comb member to be retained in a plurality of pre-determined positions corresponding to pre-determined effective teeth spacings, a plurality of holding indentations **511** are distributed on the underside of the rotary knob **51** for engagement with the stud **512**.

Turning now to the operation of the teeth spacing adjustment means, when the rotary head is rotated, the threaded portion of the shaft **52** will also rotate,

thereby causing the nut **54** to move towards or away from the rotary head **51** along the threaded shaft. Because of the engagement of the nut **54** with the indentation on the base portion **32** of the first comb member, the first comb member **30** will be brought to move along the longitudinal direction of the shaft **52**. Therefore, by disposing the shaft **52** along the first direction, the first comb member can be moved along the first direction with the elongated teeth on the first comb member moving generally parallelly to the elongated teeth on the second comb member.

As the present comb attachment is designed for operation when coupled with a hair-dryer or hair blower, one end **13** of the main housing is generally tubular and shaped corresponding to the barrel exit of a compatible hair-dryer or hair blower. In order to divert excessive warm or hot air to move away from the hair if the air outlet of the attachment is blocked while combing, downstream air diverting outlets **14** are disposed adjacent to the head portion of the main housing so that the warm or hot air can be diverted to avoid overheating the scalp.

During normal use, hot or warm hair emanating from a hot or warm air blower will warm or heat up the teeth **31, 41** on the comb attachment. When the teeth spacing has been appropriately adjusted, the hair will be under tension if the attachment is pulled against the hair. This tension together with the heat will cause straightening or styling of hair as and when desired. It will be noted that metallic teeth will be more efficient for heat transfer for the present purposes.

Referring to Figs. 8 to 11, there is shown a second preferred embodiment of a comb attachment of the present invention. Similar to the first preferred

embodiment, this comb attachment **2** also includes a main housing **10** and a comb sub-assembly **20**. The comb sub-assembly includes a first comb member **30**, a second comb member **40** and teeth width adjustment means **60**. Each of the first comb member **30** and the second comb member **40** includes a plurality of elongated teeth **31, 41** extending from a base portion **32, 42**. In general, the two embodiments are identical except for the teeth width adjustment means **60**. Similar to the first preferred embodiment, the movable first comb member is riveted to the fixed, second, comb member **40** with an elliptical aperture formed on the first comb member **30** with the same peripheral parts.

Instead of a rotary means for adjusting the effective teeth spacing, teeth width spacing adjustment means **60** in the present embodiment includes a push-tab arrangement more particularly shown in Figs. 9, 9B, 9C and 10. The push-tab arrangement includes a push-tab member **61** disposed on the top surface of the head portion **11** and an engagement member with an engagement protrusion **66** disposed underneath the top surface for selection of pitch width by a user. The engagement member includes a pair of bifurcated legs extending through the head portion **11**. An elongated hook with a protrusion **66** extending towards the underside of the head portion **11** is formed at the end of each of the bifurcated legs. The underside of the push-tab member is connected to a fork member **62** for driving engagement with a pivotal cock member **63** which is in turn connected to the first comb member **30**. The cock member **63** is pivotally mounted about an axis **64** on the head portion of the main housing **10** and includes a first end in driving engagement with the first comb member **30** and a second end in driving engagement with the fork member **62** of the push-tab **61**.

Holding means are correspondingly formed on the top portion of the main housing and the underside of the push-tab **61**. In the present embodiment, the holding means include a plurality of indentations **65** and the engagement members. The indentations **65** are formed on the main housing and arranged corresponding to discrete effective teeth spacing. The engagement means includes at least a protrusion **66** for engaging with the selected indentation in order to lock the first comb member **30** at a pre-determined position corresponding to a pre-determined effective teeth spacing. Thus, a user can select one of the discrete effective teeth spacings by selecting the positions "1", "2", "3" and "4" to conveniently select the effective teeth spacing for hair caring. The selected position will be reasonably fixed by the engagement between the protrusion **66** with the corresponding indentation **65**. This engagement can be released by pushing the push-tab member **61** away from the selected position along the second direction and the resilience of the push-tab arrangement.

Turning now to the operation of the teeth spacing adjustment means, when the push-tab is moved along the second direction, the fork member **62** disposed underneath the push-tab **61** will drive the second end of the cock which causes a pivotal movement of the first end of the cock about the pivotal axis **64**, thereby moving the first comb member **30** along the second direction to adjust the effective teeth spacing.

Referring to Figs. 12 to 14, there is shown a third preferred embodiment of the present invention of a hair care device which is configured as a comb **3**. The comb **3** includes combing means, means for adjusting effective teeth spacing, a main housing **10** and a comb sub-assembly **20**. The comb sub-assembly includes

a first comb member **30**, a second comb member **40** and teeth width adjustment means **50**. Each of the first comb member **30** and the second comb member **40** includes a plurality of elongated teeth **31, 41** extending from a base portion **32, 42**. In this preferred embodiment, the relative disposition of the comb members and the teeth spacing adjustment means **50** are generally identical to that of the first embodiment with appropriate corresponding modifications which are obvious to persons skilled in the art.

Referring to Figs. 15 to 17, there is shown a fourth preferred embodiment of the present invention configured as a comb **4** similar to that of the third embodiment but employing the teeth spacing adjustment means **60** of the second preferred embodiment.

Referring to Fig. 17A, there is shown a modified form of the comb of Figs. 15 to 17. This comb includes a movable first combing means and a fixed second combing means which are relatively movable so that the effective teeth spacing of the comb, that is, the teeth spacing traversing the comb, can be adjusted. This specific embodiment is generally identical to the embodiment of Figs. 15 to 17 except that the movable comb member **30** of the first combing means is disposed between a left fixed comb member **401** and a right fixed comb member **402** of the first second combing means. The disposition of a movable comb member **30** between the two fixed comb members **401, 402** of the second combing means alleviates or relieves the stress on the movable comb member **30** since the stress is negotiated and shared by the fixed comb members first. It will be noted that the width of the teeth, which is the dimension of the teeth along the longitudinal direction of the comb members, is comparable to the spacing between adjacent

teeth on a comb member so that the effective teeth spacing for varying the tension to apply on hair can be gradually adjusted between a maxima and a minima.

Referring to Fig. 18, there is shown a fifth preferred embodiment of the present invention configured as a hairbrush **5**. This hairbrush **5** includes a first (movable) combing means, a second (fixed) moving means, a handle and means for adjusting effective teeth spacing. In this preferred embodiment, the hairbrush includes a plurality of radially extending bristles which are organized into first combing means comprising a first group of movable bristles **531** and combing means comprising a second group of fixed bristles **532**. The movable bristles are connected to a shaft or base portion **540** which is movable along the longitudinal direction corresponding to the first direction in the earlier embodiments. The group of movable bristles **531** are translatable along the longitudinal axis (the "first direction") of the hairbrush by connection to the teeth width adjustment means similar to those described in the earlier preferred embodiments. In this specific embodiment, a rotary wheel **550** with a radial slot for engaging with a stud **560** connected to the shaft **540** is provided to move the second bristle group along the axial, or first direction are illustrated as an example.

Referring to Figs. 19 and 19A, there is shown a sixth preferred embodiment of the present invention also configured as a hairbrush **6** which includes a movable comb member **630** with teeth members **631** extending radially from the base portion **632** of the comb members. The hairbrush **6** also includes a fixed comb member **640** which are fixed to the housing **10** of the hairbrush and with teeth members **641** extending from the base portion **642** of the fixed comb member. In contrast to the hairbrush of Fig. 18, the teeth members **631** of the

movable comb member **630** of this specific embodiment are disposed intermediate between a first **641A** and a second **641B** rows of teeth members extending radially from the base portion **642** of the fixed comb member. Similar to the embodiment of Fig. 17A, this sandwiching of the movable comb member between two rows of fixed teeth members alleviates or relieves the stress from the movable teeth members for more effective and more durable brushing.

A yet further embodiment of the invention is shown in Figs. 20A - 20F. This embodiment is a hair care device in the form of a comb having a first (movable) combing means, a second (fixed) moving means, a handle and means for adjusting effective teeth spacing. The combing means **702** comprises first combing means and second combing means which are attached to the handle **701**. The first combing means includes second combing row **705**. The second combing means includes first **703** and third **707** combing rows.

As seen in Fig. 20A, the comb portion comprise at least a first comb row **703** having teeth **704** connected to the handle **701** and a second comb row **705** having teeth **706**. In this particular form, a third comb row **707** is also connected to the handle **701**.

The second comb row **705** is mounted on a substantially parallel axis to the first and third combs **703** and **707** and is moveable relative to both the first and third comb rows **703**, **707** along that parallel axis. In this manner, the second comb **705** can be moved to reduce the effective spacing **708** between the teeth in a direction transverse to the axes on which the combs are mounted.

Similar to the other embodiments above, the combing means **702** can be formed of metal, plastics or other suitable materials. When hair is engaged by the combing means **702**, pulled under tension and heated, hair straightening or styling can be done. To enhance the straightening or styling efficiency, some or all of the combing teeth or the comb rows are made of thermally conductive materials such as metal or with metal plating. With such a thermally conductive combing means, heat can be absorbed by the combing means and can be transferred more efficiently to the engaged hair, thereby enhancing styling efficiency. In the present embodiment, the second (fixed) combing means is made of metal so that can be absorbed by the base portion can then be transferred to the hair via the combing teeth. As the fixed combing means are firmly attached to the handle, they are more robust than the movable comb and can therefore resist or withstand higher combing tension. Thus, it is preferred that the teeth on the fixed comb rows are thermally conductive and made, for example, of metal or other thermally conductive materials. Also, heating means can be included to provide heating to the combing means.

The arrangement of the combs may be seen in Fig. 20F whereby the central second comb **705** is moveable in a gap **709** between the first and third combs **703** and **707**.

Movement of the second comb **705** is actuated by a user actuating a button **711** or **712**. Two buttons are provided in this embodiment and actuation of either will result in movement of the second comb **705**. The use of two buttons on opposed sides of the handle is to accommodate the actuation when the comb is held in either the left or right hands of a user.

The actuating mechanism can be seen in more detail in Fig. 20D. The button **712** is connected to a shaft **714** acting upon a cam **715**. The shaft and cam have cooperating surfaces such that depression of the button **712** and hence the shaft **714** will cause retraction of the member **76** carrying the cam surface **715**.

It will be noted that the member **716** is not directly linked to the comb **705**. Although a direct connection would cause the necessary movement of the comb **705**, this embodiment does not seek to move and lock the comb **705** by a discrete interval. Instead, actuation of the button **712** will cause continuous movement of the comb **705** and a user can dictate the resultant gap between the teeth of the combs by control of the depth of depression of the button **712**. The risk of direct connection is that a user may press to hard on the button **712** and catch hair in between the teeth causing pain or damaging the hair so caught. Of course, the direction of movement of the movable comb **705** can be changed by changing the cam surface relationship between the shaft **714** and the cam **715** without loss of generality.

To limit this effect, a pressure limiting mechanism is employed to limit the pressure applied by the teeth against the hair pressing in between.

The pressure limiting mechanism may take a variety of forms and in this embodiment is incorporating as a biasing means within the actuating mechanism.

Referring again to Fig 20D, it can be seen that movement of the member **716** away from the comb end of the device is transmitted through a second biasing means in the form of a compression spring **717** to a portion **719** that is in direct connection with the comb **705**. In turn, the portion **719** in the form of a U

shaped member is acting against the urging of a first biasing means **718** that seeks to return the comb **705** to the open position. In the embodiment, the first biasing means **718** is of lower compressive strength than the second biasing means **717**. Hence, upon movement of the button **712**, the member **716** and **717** will move substantially at the same time against the urging of the biasing means **718**. However, should the user depress the button **712** to the extent that it may place too much pressure on hair between the teeth of the comb, further movement of the comb **705** is controlled by the threshold value of the compressing spring **717**.

Referring to Fig. 20C, it can be seen that each button **711** and **712** actuates a separate shaft **714**, **721** that act upon their own cam surfaces **715**, **722**. These cam surfaces are angled in an opposed relationship on the end of the member **716** so as to act in the correct direction regardless of whether button **712** or **711** is depressed.

A yet further embodiment of the invention is shown in Fig.'s 21A-E. In this embodiment, the hair care device comprises a comb attached to a handle also employing heated air to the hair being drawn between the teeth of the comb. Otherwise, the mechanism is similar with three sets of bristles or teeth **801**, **802** and **803**, extending from a handle portion **804**. As with the previous embodiment, the middle row of teeth **802** are movable with respect to the two outer rows.

Referring to Fig. 21D, it can be seen that the actuating mechanism comprises a button **806** that in turn depresses a shaft **807** acting against an angled cam surface **808**. In this instance depression of the button moves the cam

surface towards the comb of the device to urge the movable comb **802** away from the handle.

Transmission of the force on the comb **802** is against a first biasing means **811** seeking to return the comb to the widest teeth spacing. However, this transmission of force is through a second biasing means **812** that can again limit the pressure applied laterally to hair drawn through the comb. In effect, the comb **805** is balanced between the two compression springs **811** and **812**. Provided the compressive strength of the first biasing means **811** is less than that of the second biasing means **812**, movement of the cam surface **808** will seek to move the comb **802** such that the teeth reduce the spacing between the teeth of the comb **805** and the adjacent combs **801** and **803**. Should the pressure applied to the hair be greater than the threshold value of the second biasing means **812**, further movement of the button and the cam surface 808 will only cause compression of the spring **812** and not result in further movement of the comb **802**.

A still yet further embodiment of the invention is shown in Fig.'s 22A-D in which the invention is provided in the form of a comb similar to that as shown in Fig. 20A. The difference with this embodiment is in the actuating mechanism.

Actuation is obtained by sliding the button **902** with respect to the handle **901**. As shown particularly in Fig. 22A, the movable comb **904** is movable between the outer combs **903, 905** to reduce the teeth spacing. Retraction of the sliding button **902** away from the combs causes similar movement of the member **907**. The comb **904** is connected directly to the distal portion **908** help between two biasing means **911** and **912**.

Initial movement of the slide **902** is transmitted through the member **907** and the second biasing means **912** so as to cause movement of the portion **908** and the comb **904** against the action of the biasing means **911**. As with the previous embodiments, the compressive strength of the first biasing means **911** is less than that of the second biasing means **912**. However, should the pressure created between the teeth by hair passing through the teeth exceed the threshold value of the second biasing means **912**, further movement of the slide **902** causes compression of the spring **912** instead of further movement of the comb **904**.

In the above description, the same numerals have been used to refer to parts which are common to the various embodiments without loss of generality.

While the present invention has been explained by reference to the preferred embodiments described above, it will be appreciated that the embodiments are only examples provided to illustrate the present invention and are not meant to be restrictive on the scope and spirit of the present invention. This invention should be determined from the general principles and spirit of the invention as described above. In particular, variations or modifications which are obvious or trivial to persons skilled in the art, as well as improvements made on the basis of the present invention, should be considered as falling within the scope and boundary of the present invention. Furthermore, while the present invention has been explained by reference to comb attachments, combs and hairbrushes, it should be appreciated that the invention can apply, whether with or without modification, to other hair care devices, attachments or apparatus.